Winter 2005 CSC2428 Logic & Automata

Homework 1

assigned continuously, due date TBD

Choose the problems you want to work on. You need to solve roughly 70% of the problems if you're enrolled in the course.

Problem 1 Give a complete proof of the fact that MSO = MSO_0 (where in MSO_0 we only quantify over sets but have extra atomic predicates Sng etc.

Problem 2 Give a complete proof of the Thatcher-Wright theorem (regular = MSO over trees).

Problem 2 Give details of the powerset construction for tree automata and show that it works.

Problem 4 Prove that in the alternative proof of Büchi's theorem, the automaton that we construct is deterministic.

Problem 5 Prove that emptiness for tree automata is PTIME-complete.

Problem 6 Prove Lemma 4.1 from the 4th lecture.

Problem 7 Give a polynomial time translation of an unranked tree automaton $\mathcal{A}$ into binary tree automaton $\mathcal{A}'$ such that $\mathcal{A}'$ accepts the set of translations of trees accepted by $\mathcal{A}$.

Homework 2

Problem 8 Show that over infinite trees, the Büchi acceptance condition is weaker than the Rabin acceptance condition.

Problem 9 Provide a complete proof of the fact that a set of infinite trees is regular (accepted by an automaton with the Rabin or Muller acceptance condition) iff it is MSO-definable.

Problem 10 If $\mathcal{A}$ is a tree automaton with the Rabin acceptance condition and $L(\mathcal{A}) \neq \emptyset$, then $L(\mathcal{A})$ contains a regular tree.

Problem 10 (compulsory, or if you wish, **sanity check)** Prove that $\langle \mathbb{Q}, < \rangle \cong \langle \{0,1\}^*1, \leq_{\mathrm{lex}} \rangle$.

Problem 11 (compulsory/sanity check) Prove that WS2S is weaker than or equivalent to S2S.